ROGER BACON
THE FATHER OF EXPERIMENTAL SCIENCE & MEDIAEVAL OCCULTISM

By

H. STANLEY REDGROVE

London
WILLIAM RIDER & SON, LTD.
8-11 Paternoster Row, E.C.

B
XX
IV
RAC

B.XXIV
Bac

BZP(BACON, R)

X74085

22101158411

Digitized by the Internet Archive
in 2018 with funding from
Wellcome Library

https://archive.org/details/b29978026

ROGER BACON

Works by H. STANLEY REDGROVE,

B.Sc. (Lond.), F.C.S.

ON THE CALCULATION OF THERMO-CHEMICAL CONSTANTS. (Arnold, 1909, 6*s*. net.)

MATTER, SPIRIT AND THE COSMOS: Some Suggestions towards a better Understanding of the Whence and Why of their Existence.
(Rider, Popular Edition, 1916, 1*s*. net.)

ALCHEMY: ANCIENT AND MODERN. Being a brief account of the Alchemistic Doctrines, and their Relations to Mysticism on the one hand, and to recent Discoveries in Physical Science on the other hand; together with some particulars regarding the lives and teachings of the most noted Alchemists. (Rider, 1911, *out of print.*)

A MATHEMATICAL THEORY OF SPIRIT. Being an attempt to employ certain Mathematical Principles in the Elucidation of some Metaphysical Problems.
(Rider, 1912, 2*s*. 6*d*. net.)

EXPERIMENTAL MENSURATION. An Elementary Text-Book of Inductive Geometry.
(Heinemann, 1912, 2*s*. 6*d*. net.)

THE MAGIC OF EXPERIENCE. A Contribution to the Theory of Knowledge (with an Introduction by Sir William F. Barrett, F.R.S.). (Dent, 1915, *out of print.*)

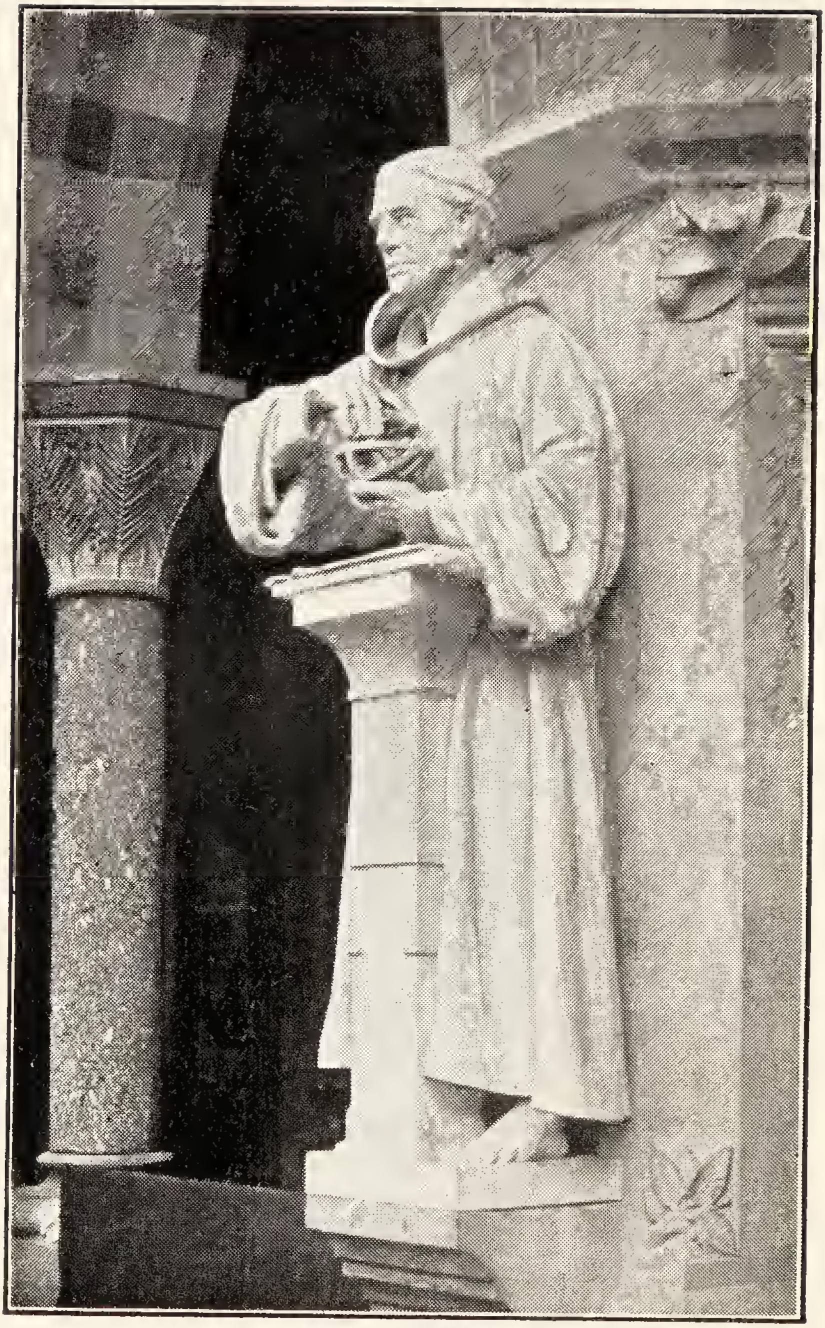
BYGONE BELIEFS. A Series of Excursions in the Byways of Thought. (Rider, 1920, 10*s*. 6*d*. net.)

PURPOSE AND TRANSCENDENTALISM. An Exposition of Swedenborg's Philosophical Doctrines in Relation to Modern Thought. (Kegan Paul, *in the press.*)

* * *

INDUSTRIAL GASES, together with the Liquefaction of Gases. By various authors, including H. S. Redgrove.
(Crosby Lockwood, 1916, 9*s*. net.)

THE INDICTMENT OF WAR. An Anthology. Compiled by H. S. Redgrove and J. H. Rowbottom.
(Daniel, 1919, 10*s*. 6*d*. net.)



ROGER BACON.

From a photograph of the statue by Mr. H. R. Hope-Pinker, erected in the University Museum, Oxford, in 1914, in commemoration of the Seventh Centenary of Bacon's birth.

[*Frontispiece.*

ROGER BACON

THE FATHER OF EXPERIMENTAL SCIENCE
AND
MEDIÆVAL OCCULTISM

BY

H. STANLEY REDGROVE
B.SC. (LOND.), F.C.S.

AUTHOR OF
"MATTER, SPIRIT AND THE COSMOS"
"ALCHEMY: ANCIENT AND MODERN"
"A MATHEMATICAL THEORY OF SPIRIT"
"BYGONE BELIEFS," ETC. ETC.

LONDON
WILLIAM RIDER & SON, LTD.
8 PATERNOSTER ROW, E.C.
1920

WELLCOME
HISTORICAL
MEDICAL
LIBRARY

CONTENTS

CHAPTER I

PAGE
THE MOULDING OF ROGER BACON'S MIND 7

CHAPTER II

THE FRUITS OF ROGER BACON'S LEARNING 19

CHAPTER III

ASTROLOGY 30

CHAPTER IV

ALCHEMY 37

CHAPTER V

MEDICINE 47

CHAPTER VI

MAGIC AND THE DISCOVERY OF GUNPOWDER 55

NOTE ON THE PORTRAITURE OF ROGER BACON

So far as is known, no contemporary portrait or effigy of Roger Bacon exists, and it is not claimed for Mr. Hope-Pinker's fine statue that it is more than an imaginative representation of what Bacon may have been like. The photograph of this, which was very kindly supplied by Mr. H. L. Bowman, Secretary of the University Museum, Oxford, is reproduced by kind permission of the Delegates of the Museum.

Reproductions of what are in all probability the earliest known portraits of Roger Bacon will be found in my *Bygone Beliefs*, plates 28 and 29.

H. S. R.

ROGER BACON

CHAPTER I

THE MOULDING OF ROGER BACON'S MIND

In 1914 two momentous events occurred: the outbreak of the European war and the celebration at Oxford of the septcentenary of the birth of Roger Bacon. I suppose most people regard the first event as momentous: the second, if heeded at all, is placed by them in the category of the unimportant. But as in the past, so in the present, the evolution of humanity proceeds but little disturbed by the rise and fall of dynasties and alterations in national boundaries. Conquests by arms are trivial in their permanent effects compared with the conquests of mind over matter. In the world of thought, there are the sources of progress to be found, and it was a significant fact—and momentous in its significance—that men of learning in 1914 found it in their hearts to do homage for the first time to Roger

Bacon. For long he had suffered calumny and neglect; though unlike so many innovators in scientific speculation, it is true that he escaped torture and death at the hands of his contemporaries. But nevertheless he suffered much persecution, as we shall learn in what follows, and for a considerable portion of his life he was restrained from writing—a grievous punishment indeed to a man of his stamp. And during every century that succeeded him up to the eighteenth, when in 1733 the greater portion of his *Opus Majus* was published, under the able editorship of Dr. Samuel Jebb, he was classed with mountebanks and the workers of false miracles. He was a charlatan—an alchemist and a magician, where these words imply the lowest depths of charlatanry and chicanery—in the eyes of the learned and the unlearned alike, with few, though these are outstanding, exceptions.

In Frost's *Lives of the Conjurors*, we read that:

> "While pursuing his studies at Oxford, Bacon became intimately acquainted with the friar Bungay, who was almost as proficient in magic as himself, though he does not figure in the records of scientific research. These two conjurors constructed a brazen head, concerning which we are told . . . that 'in the inward parts thereof there was all things like as is a natural man's head.' Unable to give their handi-

work the power of speech, they resolved to invoke the aid of Satan; and, with this desperate resolve, proceeded to a wood, in the deepest dingle of which they drew a magic circle, and pronounced an awful incantation. The devil appeared, in the form assigned to him by Anglo-Saxon ignorance and superstition; but declared that he did not possess the power for which the Franciscans gave him credit. Upon being rebuked by Bacon for falsehood, and threatened with bonds, his Satanic majesty informed them that the vapour of six of the most pungent simples known would cause the head to speak in a month: adding, that their labour would be in vain if they did not hear the voice themselves.

"The friars dismissed the fiend, and returned to their laboratory, where they prepared the needful decoction, and watched its effects night and day for three weeks. Being then overpowered by somnolence, Bacon's servant, Miles, was set to watch the brazen head, with strict injunctions to call the two friars in the event of any articulate sounds proceeding from it. Miles tried to keep himself awake by singing, but he did not succeed; and when he was awakened by hearing the head pronounce the words 'Time was,' he thought such a brief utterance too insignificant for notice, and went to sleep again. Presently the words 'Time is' issued from the brazen lips; but Miles thought the remark as unworthy of attention as that which had preceded it. Then came the final utterance, 'Time is past!' upon which lightning flashed and thunder rolled, and the brazen head fell upon the floor, and was broken to pieces. The friars rushed in at the noise, and Bacon, in his rage at the disaster, would have severely chastised the negligent Miles, if his brother Franciscan had not restrained him."[1]

This story of the brazen head figures prominently in a romance first printed at the close of the sixteenth century, or early in the seventeenth, under the title of *The Famous Historie of Fryer Bacon,*[2] a book which became exceedingly popular, and which, with slight variations, passed through almost innumerable editions. Robert Greene's *The Honourable History of Friar Bacon and Friar Bongay,* a play first printed in 1594, but performed at least two years earlier, is thought to be based on a MS. copy of this work. The story of the brazen head plays an important part in *The Honourable History,* and in consequence of the wide popularity of both the play and the romance, became widely disseminated. In fact, it appears to be almost the only thing concerning Roger Bacon that was remembered by succeeding ages. It is scarcely necessary to add, as a commentary on their estimate of him, that the story is entirely apocryphal.

Momentous indeed, then, was the coming

---

[1] Thomas Frost: *The Lives of the Conjurors* (1881), pp. 42–4.

[2] See William J. Thoms, F.S.A.: *Early English Prose Romances*, vol. i (1858), pp. 181–250.

into his own by Roger Bacon in 1914, but still more momentous was that which took place seven hundred years previously. It is, indeed, hard to over-estimate the importance—when all the ramifications of the effects of the event are taken into account—of the birth of a genius, and especially of that genius of whom it has well been said :

> " He [Roger Bacon] is to be regarded as the intellectual originator of experimental research, if the departure in this direction is to be coupled with any one name—a direction which, followed more and more as time went on, gave to the science [of chemistry] its own particular stamp, and ensured its steady development." [1]

As a matter of fact, some doubt exists as to the exact date of Bacon's birth, but 1214 is the most probable year. The place was at or near Ilchester in Somersetshire, and his parents probably persons of some considerable means. Concerning his life not a great deal is known with certitude ; it is possible to make out a fairly connected story, but many of the events in it have to be qualified as " probable " or " most probable." His early education was undertaken at Oxford University, where he came under the influence of Robert Grosseteste, a man gifted with a mind, extraordinarily broad for the period, in which were the seeds of the scientific spirit. Bacon graduated M.A. at a date not known, and gained considerable reputation for his knowledge both at Oxford and later at Paris, where he proceeded, as was the usual course, to study theology. The exact date of his first visit to Paris is doubtful. It was certainly not later than 1245. Nor do we know the date or the reason of his joining the Franciscan Order, though probably this took place while he was at Oxford, and the motive was the desire for the protection of a powerful organisation and the facilities for study that membership provided.

---

[1] Ernst von Meyer : *A History of Chemistry* (translated by Dr. McGowan, 1906), p. 35.

At Paris, Bacon found himself in an atmosphere far less congenial than that in which his mind had so far developed at Oxford. Oxford was not hide-bound, with mind alert only to the arid arguments of scholastic theology. Oxford was the home of such thought of the age as deserves to be called liberal. Mathematics was honoured there, and even experimental science was recognised. Bacon himself remarks that at Oxford, and at Oxford alone, lectures on perspective, or optics as we should now say, had been delivered —by Grosseteste no doubt. Paris was the antithesis of all this, as Alexander of Hales' mind—

which dominated Paris—was the antithesis of that of Robert Grosseteste. Permission had just been granted, it is true, for the study of physics, metaphysics and psychology at Paris; that is to say, of the works which Aristotle had written under these titles, not the sciences themselves. Bacon, however, though he by no means despised or undervalued the learning that is gained from books, believed in questioning nature herself: he believed in experiment and the experimental method. But, nevertheless, he made himself a master of scholastic dialectic—though he did not graduate Doctor of Theology at Paris, as has frequently been stated—and attacked his opponents in their own language. At Paris, however, he did meet one congenial spirit: to wit, Peter Peregrinus de Maricourt or de Mahariscuria, who would be almost unknown to us but for the references to him in Bacon's works.[1] Judging from these, however, this mysterious personage appears to have towered head and shoulders above his contemporaries.

---

[1] He was the author of a work on the Magnet, remarkable in many ways for the period. See Silvanus P. Thompson, F.R.S.: "Petrus Peregrinus de Maricourt and his Epistola de Magnete," *Proceedings of the British Academy* (London, 1906), pp. 377–408.

Fired by the spirit of research, we learn, he pursued in private his studies into the mysteries of nature, heedless of the battle of words taking place around him. Bacon calls him, in one of his eulogies, " a master of experiment," and concerning him writes as follows:

> "Through experiment he gains knowledge of the things pertaining to nature and medicine and alchemy, and all that is in heaven and in the earth beneath. Nay, he is ashamed if any old woman or soldier or countryman knows about the country what he does not know. So he has pried into all the works of metal-founders, and what is wrought in gold and silver and the other metals and all minerals. He knows all that concerns the art of war, the making of weapons, and hunting; he has examined all that belongs to agriculture and surveying and the operations of farmers; moreover, he has considered the experiments and the fortune-telling of old witches, and their spells and those of all magicians; and so, too, the illusions and wiles of all conjurers; and this to the end that nothing may escape him which ought to be known, and that he may perceive how far to reprove all that is false and magical. So without him philosophy cannot be completed, nor yet handled with advantage and certainty. But just as he is too worthy for any reward, so he does not seek one for himself. For if he wished to dwell with kings and princes, he could easily find those who would honour and enrich him. Or if in Paris he were to display his knowledge through the works of wisdom, the whole world would follow him. But because in both these ways he would be hindered from the bulk

of the experiments in which lies his chief delight, he neglects all honours and riches, especially since he will be able, when he wishes, to reach riches by his own wisdom." [1]

These words portray a man who would be great in any age, a man far in advance of the thirteenth century. His influence on Bacon was tremendous, and Bacon took his friend's life as the pattern after which to model his own, succeeding so admirably that the passage quoted above might be well taken as a description of Bacon himself.

Next in importance to Oxford and Peter de Maricourt in their influence on Bacon must be placed the works of the Arabian writers, in particular Avicenna, Alhazen, Averroës, and Al Ghazzali, as well as other men eminent in the Mohammedan schools of learning. It was through these men that Greek philosophy and science were first introduced to the Western world; it was they who had kept the torch of learning alight during the centuries of intellectual darkness in Christian Europe. Bacon not only valued their works for this; he also recognised that in many cases they had not only preserved the treasures of Greek thought, but had made many valuable additions thereto.

---

[1] Roger Bacon: *Opus Tertium*, cap. xiii. See *Fr. Rogeri Bacon: Opera quaedam hactenus inedita*, edited by J. S. Brewer, M.A., vol. i ("Rolls Series," 1859), pp. 46 and 47.

Such were the influences that went to the moulding of the mind of Roger Bacon. They produced a man who might seem egotistical in argument, but whose mind was humble to learn. Though a faithful son of the Church he called "Catholic," he did not disdain to read the works of heretics and infidels, realising that God is ever generous with his gifts, and believing that in so far as such men wrote truly and well, they were bearing unconscious testimony to the truth of Christianity. Nor did he disdain to learn of common folk. He was prepared to give ear to all, to test all things by experiment and to hold fast to that which was thereby proved to be true. Such an attitude is the reverse of superstitious, and Bacon rejected many of the magical beliefs of his day, though he gave credit to astrology and alchemy, as we shall see later, because, rightly or wrongly, they seemed to him to be justified by experience. In particular he valued mathematics as an instrument of thought—speculation guided by mathematics and verified by experiment sums up briefly the method his mind was led to formulate. His presentation of this method is, of course, very crude and lacking in definiteness judged by modern standards. In particular, he persistently confused experiment and experience; and he is open to criticism in that he did not himself always and consistently follow his own method.[1] But the fact remains that he was the first to formulate the method which is that of modern science, and to which the astonishing wealth of knowledge concerning nature, and the control over nature that this knowledge gives, possessed by the civilised world to-day, is due. For too long the light of his better-known namesake Francis[2] has obscured that of Roger. Francis Bacon, no doubt, gave a tremendous impetus to the use of the inductive method; but unfortunately he failed to appreciate the tremendous value of mathematics as an instrument of research; and there can be no doubt that the advancement of learning would have been greatly accelerated had the adoption of mathematical methods not been delayed until quite recent years.

---

[1] For some not altogether undeserved criticisms of Bacon's methodology and his use of it, see Lynn Thorndike's *Roger Bacon and Experimental Method in the Middle Ages* (reprinted from *The Philosophical Review*, vol xxiii, No. 3, May 1914). See also the chapter on "Roger Bacon" in Henry Osborn Taylor's *The Mediæval Mind* (2nd edition, 2 vols., 1914).

[2] It may be noted that no genealogical connection has been traced between the two Bacons.

During that period of his life with which I have already dealt, Roger Bacon had committed comparatively little to writing. Of his works and their contents, the reception they met with, and the reward that was meted out to Bacon for them by his contemporaries, we shall learn something in what follows.

CHAPTER II

THE FRUITS OF ROGER BACON'S LEARNING

In or about 1250, Roger Bacon appears to have returned to Oxford, devoting his time to study, the setting down of his views in writing, and the teaching of languages, mathematics, and the use of scientific instruments. It may be remarked that his passion for mathematics was quite equalled by that which he had for languages. He considered the acquisition of the latter to be of the greatest importance; and when we consider how large a proportion of the sum total of human learning in the thirteenth century was bound up in Greek—not to mention that only to be found in Hebrew and Arabic—we shall realise how right he was. What translations were available were severely criticised by Bacon, and not without justification, for they were deplorably bad, though it must be confessed that he sometimes went to extremes in his denunciations.

It has been repeatedly stated that, in 1256 or 1257, Bacon incurred the condemnation of his Order, was removed from Oxford, and placed under close supervision in Paris. Mr. A. G. Little,[1] however, regards this as an error arising from a misunderstanding of a passage in one of Bacon's works. Bacon, he says, was not imprisoned, but retired from taking any public part in university affairs on account of ill-health. Be that as it may, however, the letter which Bacon received from the Pope—Guy de Foulques, Pope Clement IV—in 1266, commanding him to send His Holiness his works, in secret and with all speed, "notwithstanding the prohibition of any prelate, or any constitution of his Order," seems in its wording to countenance the idea that all was not well as concerns the relations between Bacon and the Franciscans.

This letter was Bacon's great opportunity, and his gratitude knew no bounds. It is exceedingly difficult to fix the dates of the majority of the numerous works by, or attributed to, Roger Bacon, but the following may with some degree of probability be ascribed to the period prior to Bacon's receipt of the Pope's letter: *Tractatus de Multiplicatione Specierum* (on the propagation of force), *De mirabili potestate artis et naturae* (a curious and fascinating little book, with which we shall become better acquainted later), *De speculis comburentibus*, *Computus Naturalium* (a treatise on the Calendar, written *circa* 1263), *De retardandis senectutis accedentibus et de sensibus conservandis*, the *Metaphysica*, and perhaps one or two other treatises. None of the works already written, however, were deemed by Bacon to be adequate for the purpose that now presented itself. They dealt merely with certain aspects of his philosophy, not with that philosophy as a whole. He wrote, therefore, an apology to the Pope, explaining the difficulties that beset the fulfilment of the latter's behest, and essayed to complete an encyclopædic work, the *Scriptum Principale*, dealing systematically with every branch of knowledge, a work on which he had probably started before the momentous letter arrived. The project, however, proved too vast for achievement in the time at his command, and Bacon abandoned it for the moment, writing instead a preliminary treatise known as the *Opus Majus*, vast enough in its dimensions, though modest compared with the first projected book. The writing of this work took

---

[1] A. G. Little: "Introduction on Roger Bacon's Life and Works," *Roger Bacon: Essays contributed by various Writers on the Occasion of the Commemoration of the Seventh Centenary of his Birth* (Oxford, 1914), p. 7.

Bacon less than twelve months. In another six he had completed two more works—the *Opus Minus*, a supplement to the former work, which was sent to the Pope along with it, and the *Opus Tertium*, a further supplement and summary, to be dispatched after the two former, in case they should not reach His Holiness. Certain of his already written works appear to have been sent as well.

Did the books ever reach Clement? And if so, how were they received by him? We do not know. What we do know is that Clement died in 1268, less than a year after the dispatch of the books, so that any favourable impression they may have made on his mind would hardly have had opportunity to bear the fruit of reward for Bacon.

The *Opus Majus* may well be regarded as Bacon's most important work. It is divided into seven parts as follows:

Part 1.—Concerning the four Universal Causes of Human Ignorance and Error.
  (These are: (1) Dependence on unworthy authority;
    (2) Yielding to established custom;
    (3) Allowing weight to popular prejudice;
    (4) Concealment of ignorance by a pretence of knowledge.)
Part 2.—Concerning the Connection of Philosophy with Theology.

Part 3.—Concerning the Usefulness of Grammar, *i.e.*, the Study of Foreign Languages.
Part 4.—Concerning the Usefulness of Mathematics for Science, Theology, and the State.
(Includes chapters on Light and other Natural Phenomena, Application of Mathematics to Philosophical Speculations, Chronology and the Correction of the Calendar, Astronomy, Astrology, Geography, Music, etc.)
Part 5.—Concerning Perspective (or Optics).
Part 6.—Concerning Experimental Science as a General Means of Investigation and Verification.
Part 7.—Concerning Moral Philosophy.

The sixth part of the work is undoubtedly the most important. Writes Bacon:

> "There are two methods of obtaining knowledge—by argument and by experiment; argument makes conclusions and forces us to agree to them, but it does not make us feel certain or so remove suspicion that the mind rests in assurance of truth, unless this be also found by experience."[1]

These words may sound rather trite to modern ears—to appreciate their significance we must reconstruct something of the intellectual atmosphere of the Middle Ages. Man, no doubt, from the very moment of his birth had been testing things by his experience; but he had, in the days of which I am writing, become obsessed with the idea that authority and not experience was the true basis of certitude. He had shut his eyes to the world of nature, and spent his time in never-ending arguments concerning passages in the Bible and the works of Aristotle, imagining that by the alchemy of logic everything knowable might be learned from these sources. Bacon, on the other hand, though he believed with all sincerity in the absolute veracity of the Bible, and admired the wonderful genius of Aristotle, realised that mere logic was not capable of discovering truth, nor mere logical consistency of satisfying the enquiring and sceptical mind. He was certainly not the first experimentalist,[1] but I think that no one previously to him had so clearly realised the significance of experiment as the basis of scientific method, and, as I have remarked elsewhere, "he was assuredly the priest who joined mathematics to experiment in the bonds of sacred matrimony."[2] He writes:

---

[1] Roger Bacon: *Opus Majus*, Pars. VI, cap. 1. See *The "Opus Majus" of Roger Bacon, edited, with Introduction and Analytical Table*, by John Henry Bridges (Oxford, 1897), vol. ii, p. 167.

---

[1] Ptolemy, Galen, and the Arabian astronomers may be especially mentioned amongst the experimentalists who preceded him.

[2] Quoted from my "Roger Bacon: an Appreciation," *Bygone Beliefs* (1920), p. 189.

> "He who is ignorant of mathematics cannot know the other sciences; and the things of this world. . . . Moreover, what is worse, men who are ignorant of mathematics do not perceive their ignorance, and therefore seek no remedy. While, on the other hand, a knowledge of this science prepares the mind and elevates it to a sure knowledge of all things; so that if it perceives the roots of wisdom which surround this science and applies these roots to an enquiry into other sciences and things, then it will be able to know all things in sequence without doubt or error, and in ease and power."[1]

To Bacon, however, perhaps the last part of the *Opus Majus* was the most important. It was the summit of the whole work. In comparison with moral philosophy, all the natural sciences seemed to Bacon to be merely speculative; it alone was really practical, for it alone dealt with man's conduct and life. It shared something of the dignity of theology, to which Bacon made all the other sciences subservient.

With the majority of his contemporaries he agreed in holding that all knowledge went to the writing of the Bible—in addition, however, he argued that all knowledge was necessary to the understanding of its words, both in their literal and in their mystical sense. To understand these aright, he urged, we must not only become well acquainted with the languages in which they were written, but must study every branch of science so as to appreciate the innumerable references to natural phenomena and the works of handicraft with which the Bible abounds. Thus, all the other sciences exist primarily for the full and complete understanding of theology, queen of them all. Such is the impression one gets from the study of the *Opus Majus* and its supplements; and whilst the attitude towards theology there displayed supplies a certain principle of unity to the works, it is one by no means acceptable to modern thought. There is, however, nothing surprising in the over-estimation of the importance of theology on the part of a scholar of the thirteenth century, and Bacon, though in many ways far in advance of his age, was nevertheless a child of that age, with many of the faults common to his contemporaries. Moreover, we have to remember that the works in question were written, not for the public, but especially for the Pope, and the suspicion is not unjustified that, possibly, the utility of the sciences for theology is with Bacon not so much the *reason* as the *excuse* for their study. Bacon lived in an age dangerous for men of speculative mind, and undoubtedly his conformity (whether it was real or only apparent) to the requirements of orthodoxy saved him from the stake and his works from destruction.

---

[1] Roger Bacon: *Opus Majus*, Pars. IV, Dist. i, cap. 1. See edition cited, vol. i, pp. 97 and 98.

But if he displayed no little worldly wisdom in the arguments he adduced to convince the Pope of the benefits of the study of science, he threw all caution to the winds in his *Compendium Studii Philosophiae*, which we next find him writing at Oxford about 1272. This work was probably intended as an introduction to the encyclopædic *Scriptum Principale*, which was, so far as we know, never completed. The intellectual and moral vices of the day, more especially on the part of the clergy, were such that a man of Bacon's sturdy mentality could not tolerate, and in the *Compendium* he broke out into more violent criticism and invective against both Franciscans and Dominicans than before. The result could be foreseen, and in 1277 action was taken by the Franciscan Order, and Bacon was thrust into imprisonment on the charge of teaching "suspected novelties." Exactly what the "suspected novelties" in question were we do not know: there were certainly plenty of these to be found in Bacon's works. In the thirteenth century any knowledge of natural phenomena beyond the quasi-science of the times was liable to be classed as magic.

Astrology and alchemy were suspect, and certainly it was a novelty for a Christian philosopher to laud the moral teachings of infidels like Seneca and Al Ghazzali. But, above all else, to criticise the clergy because they (very rightly in the eyes of the ecclesiastic powers) remained content with authority as the only criterion of truth, and to assert the necessity of experimental confirmation: that was most heretical teaching, a novelty that could not be tolerated. The Pope was appealed to, but Jerome d'Ascoli, General of the Franciscan Order, and Bacon's arch-enemy, saw to it that such efforts to secure Bacon's release were futile. He shortly afterwards succeeded to the Papal See himself, assuming the title of Nicholas IV. In 1292 he died, whereupon Raymund Gaufredi, who had been elected General of the Franciscan Order, and who was well disposed towards Bacon on account, it is thought, of certain alchemical secrets the latter had disclosed to him, had Bacon set at liberty.

Bacon returned to Oxford, and commenced to write his last work, the *Compendium Studii Theologiae*. In this he again returned to his persistent theme, the causes of human ignorance, though in somewhat milder terms than formerly. The work appears to have been unfinished at the date of his death, which occurred in either 1292 or 1294.

Such was Roger Bacon—a man of encyclopædic learning, versed in every branch of knowledge known in his day, a man of sturdy intellect—one of the earliest of those "tough-minded" philosophers, questioners of nature, to whose combined efforts almost the entire advancement of human learning is due. He was a fiery and impetuous spirit, in many ways too impetuous; and yet withal a man of true piety and nobility of character. Something of his learning I have already endeavoured to display—something of his views, and of his outstanding achievement, namely, his contribution to methodology. In the following chapters I shall endeavour to treat in more detail certain aspects of his philosophy, more especially in their relation to mediæval occultism.

CHAPTER III

ASTROLOGY

Roger Bacon has often been maligned for his belief in astrology and alchemy. But as the late Dr. Bridges, who accepted the claims of neither, pointed out, not to have believed in these occult sciences in Bacon's day would have been by no means an indication of a vigorous mentality. Astrology probably, and alchemy certainly, had an *a priori* basis; but, on the other hand, they both claimed experimental verification for their doctrines, and, in the light of what facts were known in the thirteenth century, these claims must have appeared to be good. Concerning astrology, Dr. Bridges writes:

> "It has often been remarked that Roger Bacon was supported by Albertus Magnus, by Aquinas, and, indeed, all the best thinkers of his time in his conviction of the truth of astrology. To a believer in a limited and spherical universe with a terrestrial centre, nothing could seem more valid as a working hypothesis for explaining physical changes on the earth's surface than that alterations of the directions

in which the planets were seen should be followed by corresponding alterations of terrestrial objects. The combinations of planetary bodies, as seen in conjunction, in opposition, or in intermediate positions, offered a wide field of speculation, which became practically boundless when to the apparent relation of these bodies to one another were added their apparent relations (also ever varying) with the fixed stars. Human and terrestrial events, complicated as they might be, were paralleled by equal complication in the play of celestial forces. It may be said on the whole that so far from belief in astrology being a reproach to Bacon and his contemporaries, to have disbelieved in it would have been in the thirteenth century a sign of intellectual weakness. It conformed to the first law of Comte's *philosophia prima*, as being the best hypothesis of which the ascertained phenomena admitted."[1]

But, indeed, I think something further even than this may be said in justification of Bacon's belief in astrology—in his belief, common to practically all the scholars of the Middle Ages, that amongst the various forces whose resultant is the whole panorama of natural phenomena, such as climatical changes, as well as the vagaries of temperament and character, and the consequent moral life of man, must be reckoned the influences of the celestial bodies. It seems to be invariably assumed by modern writers that, at some time or another, the doctrines of astrology were proved to be unfounded; but we search the history of science in vain for the record of this achievement. What actually happened was that, as the geocentric hypothesis was abandoned, and a new view of the nature of the universe was evolved in the mind of man, the doctrines of astrology were discarded. Of the two factors, the second was by far the more potent, for it can hardly be seriously contended that the conviction that the earth is not the centre of the universe prohibits one from a belief that this earth and its inhabitants are subject to influences from other celestial bodies. In other words, astrology was discarded because its doctrines did not fit in with the teachings of the New Materialism which arose as a result of the over-exuberance of man when he first cast off the shackles of authority and began to realise something of the meaning and power of science. Thus, the reasons for the abandonment of astrology were essentially *a priori* and, at the most generous estimate, no better than those on account of which its teachings were previously adopted. At any rate, the mediæval astrologers appealed to experience for the proof of their teachings, and as I have indicated already, it was just because this appeal seemed to be justified that Bacon pledged his faith in astrology. There has been established for many years a Society for Psychical Research to enquire into the authenticity of phenomena seemingly duplicating the alleged products of necromancy and allied magic arts of the Middle Ages. Is it not time that a society was formed to look into the claims of astrology in a like impartial spirit? These claims have never been proved or disproved by a body of accredited investigators in a manner acceptable to all reasonable minds. Until that has been done, it is perhaps advisable not to make excuses for Bacon's belief in astrology. Perhaps he was wiser in the matter than we are.

---

[1] John Henry Bridges, M.B., F.R.C.P.: *The Life and Work of Roger Bacon: an Introduction to the "Opus Majus"* (London, 1914), pp. 83 and 84, footnote.

The doctrines of astrology are not infrequently regarded as prohibiting a belief in the freedom of the will, and as necessarily bound up with a fatalistic view of life. This is no doubt true of these doctrines as expounded by some, but it is certainly not true of its most noted exponents, amongst whom Aristotle, Plato, Pliny, Cicero, Avicenna, Aquinas and Roger Bacon himself must be included. Writes Bacon in his *Opus Majus*:

"In human affairs the true mathematician does not presume to make certain fixed statements, but considers how the body is altered by climate, and how, when the body is altered, the soul is roused now to private actions and now to public, though the liberty of decision is yet kept safe in all. For though the rational soul is not compelled to perform its own actions, yet it can be subjected to strong inducements, and roused so that it may voluntarily desire that towards which the celestial force may incline it, just as we see men through fellowship and counsel change their original feelings of fear and love and much of this nature, and voluntarily desire what previously they did not desire, though they are subjected to no compulsion, just like the man who hurls his most precious merchandise into the sea in the hope of safety. But we see that the forms and properties of lower things change our senses, even though they be but forms of things visible and audible which affect the body but slightly; and so strongly do they rouse men to desiring things for which they formerly cared nothing, that sometimes they reck nought of death or dishonour or fear, so long as they sate their lusts. . . . But the power and form of the heavens and the stars are far more mighty to press down upon body and organs, and when these have been greatly altered, a man will be stirred violently to actions for which he cared not a whit before, though his free will is yet left to him."[1]

A certain theosophic school of thought, which credits the validity of astrology, rejects the idea of any actual influence from the celestial bodies acting on the mind. On the contrary, it regards all causation as having its roots in a transcendental realm; but it considers the physical universe as a symbol of this higher or interior realm, and believes therefore that the heavens are a glass wherein we may see depicted the material and symbolic images of the forces that are operative. Astrology, from this point of view, is the art of reading cosmical hieroglyphics. The theory is an interesting one philosophically; but it does not appear to figure at all in the works of Bacon.

---

[1] Roger Bacon: *Opus Majus*, Pars. IV. See edition cited, vol. i, p. 249.

The opening words of the quotation from Bacon I have given in the penultimate paragraph may serve to remind us that in the Middle Ages, not only was there no distinction drawn between astrology and astronomy, but also that both were regarded as a branch of mathematics, and the term "mathematician" was often used to designate an astrologer. Bacon himself points out the loose way in which the words "astrology" and "astronomy" were employed in his day, and draws a distinction between them, though not one in accordance with modern usage. "Astrology" for him meant the theoretical or "speculative" side of the science of celestial bodies, dealing with planetary motions, whilst "astronomy" designated the practical side, and was concerned with the construction of tables and the prediction of future events. As concerns Bacon's work in the accredited branch of the science, mention must be made of the fact that he was aware of the inaccuracy of the Julian Calendar. He pointed out—though the fact must have been previously known to certain of the Arabian astronomers—that the Julian Calendar made the year too long by $\frac{1}{130}$ of a day, and, in consequence, was in the thirteenth century ten days in error. Paul of Middleburg's great work on the Calendar[1] is very largely based on that of Bacon—without acknowledgment, as was by no means unusual in the Middle Ages—and when we consider the very great influence of Paul of Middleburg on Copernicus, we shall realise that in this connection, at least, the work of Roger Bacon was not wasted, but in due season bore its fruits to the advantage of mankind.

---

[1] *De recta Paschae celebratione* (1513).

CHAPTER IV

ALCHEMY

SECTIONS of the *Opus Majus, Opus Minus,* and *Opus Tertium* are devoted to the subject of alchemy ; in addition a large number of works dealing specifically with alchemy are attributed to Roger Bacon, of which some are undoubtedly authentic, whilst others are in all probability the work of other writers. Amongst the authentic works may be included his *Tractatus expositorius enigmatum alchemiae* and *Breviloquium alkimiae,* also, though with a less degree of certainty, *Radix mundi* and the *Speculum Alchemiae* printed at Nürnberg in 1541, which was translated into English and published under the title of *The Mirror of Alchimy* in 1597.[1] Several other works with this title, purporting to be Bacon's, also exist. One of these, which was translated into English and published in the *Collectanea Chymica* in 1684, is possibly the work of Arnold de Villanova.

---

[1] Another translation of the same work appears under the title of *Speculum Alchimiae* in Wm. Salmon's *Medicina Practica : or, the Practical Physician,* etc. (1707).

Writes Bacon in *The Mirror of Alchimy*:

> "*Alchimy* is a Science, teaching how to transforme any kind of mettall into another: and that by a proper medicine, as it appeareth by many Philosophers Bookes. *Alchimy* therefore is a science teaching how to make and compound a certaine medicine, which is called *Elixir*, the which when it is cast upon mettalls or imperfect bodies, doth fully perfect them in the verie projection."[1]

In common with contemporary alchemical philosophers, Bacon regarded all the metals as generated in the womb of nature by the interaction of the two alchemical principles called "sulphur" and "mercury."[2] Pure mercury matured by pure sulphur produced pure gold, the perfect metal; but if either the mercury or the sulphur was contaminated by impurities, or the maturing process was not carried to completion, some other metal resulted—lead being regarded as the least pure and matured, whilst silver was thought to be the most perfect metal next to gold. It was the business of the alchemist not only to emulate nature, but to perfect her, so that, by copying and improving upon her methods, he might effect in his laboratory the evolution of the metals more speedily than occurred in the mines, and, by carrying the process a stage further, so to speak, obtain the essence of gold—the Philosopher's Stone—the medicine of the metals which would perfect them all in the twinkling of an eye.

---

[1] *Op. cit.*, p. 1.

[2] In the fifteenth century a third principle, salt, was added, probably by Isaac of Holland. See my *Alchemy: Ancient and Modern* (1911), sec. 42, pp. 53 and 54.

The whole of mediæval alchemical theory was a vast—in many ways fantastic, in some ways imposing—*a priori* structure, and constitutes perhaps the most striking achievement of the two outstanding forces operating on the mediæval mind, namely, Scholasticism and Mysticism. It took as its basis the truth of the Hermetic axiom, "What is below is like that which is above, and what is above is like that which is below, to accomplish the miracles of the One Thing," and using analogy as its instrument of thought, endeavoured to explain chemical and physical phenomena by means of doctrines drawn from the domain of mystical theology. Thus its sulphur and mercury are not ordinary brimstone and quicksilver (though the alchemists themselves frequently confuse them), but hypothetical principles in the metals corresponding to the soul (affections and will) and spirit (intelligence) in man; and its belief in the evolution of the metals from lead to gold, and the possibility of achieving this instantaneously by means of the Philosopher's Stone was an attempt to apply to chemistry the mystical doctrine of man's regeneration.[1]

This being so, it might be regarded as surprising that Bacon, the believer in the experimental method, should so easily have accepted current alchemical theories; but whilst alchemy most certainly had an *a priori* origin, experimental evidence seemed to be forthcoming for all, or nearly all, its claims. It is true that base metals had not been transmuted into gold, but numerous other instances of what seemed to be transmutations, such as iron into copper,[2] and water into earth,[3] were known. In fact, like astrology, the alchemical doctrines fitted the known relevant facts better than any alternative hypothesis, and, whatever may be urged against them, led men to study chemical phenomena, and resulted in the discovery of many bodies, useful in medicine, in the arts, and for the further advancement of chemical knowledge.

---

[1] For a full account of the nature and origin of alchemical philosophy, see my *Alchemy: Ancient and Modern* (1911), especially chap. i, "The Meaning of Alchemy"; and *Bygone Beliefs* (1920), chap. ix, "The Quest of the Philosopher's Stone," and chap. x, "The Phallic Element in Alchemical Doctrine."

[2] Iron vessels placed in a solution of blue vitriol become coated with copper, the copper being originally contained in the vitriol.

[3] The purest water leaves an earthy, solid deposit on evaporation in a glass vessel, due, as Lavoisier showed in the eighteenth century, to its action on the glass.

With regard to the preparation of the Philosopher's Stone, Bacon gives very clear and precise directions concerning the fire, the vessel to be employed, and the process generally, which he warns us must imitate nature in her simplicity.[1] One process only is necessary, he says, namely, "continuall concoction" in the fire, which is the method that "God hath given to nature."[2]

As to what is to be concocted, however, he is less explicit. In agreement with the sulphur-mercury theory, already noted, he writes:

> "The natural principles in the mynes, are *Argent-vive*, and *Sulphur*. All mettalls and minerals, whereof there be sundrie and divers kinds, are begotten of these two: but I must tel you, that nature alwaies intendeth and striveth to the perfection of Gold: but many accidents coming between, change the mettalls. . . . For according to the puritie and impuritie of the two aforesaide principles, *Argent-vive*,

---

[1] The doctrine of Nature's simplicity was one invariably accredited by the alchemists; only as the result of unremitting research has man begun to learn how infinitely complex Nature actually is.

[2] *Op. cit.*, p. 9.

and *Sulphur*, pure and impure mettals are ingendred." [1]

It is necessary, therefore, to work with mercury and sulphur, or, rather, with some material containing these two in right proportion. Animal and vegetable substances are ruled out, as not sufficiently akin to the metals:

> "Nothing may be mingled with mettalls which hath not beene made or sprung from them, it remaineth cleane inough, that no strange thing which hath not his originall from these two [viz., sulphur and mercury], is able to perfect them, or to make a chaunge and new transmutation of them: so that it is to be wondered at, that any wise man should set his mind upon living creatures, or vegetables which are far off, when there be minerals to bee found nigh enough: neither may we in any wise thinke, that any of the Philosophers placed the Art in the said remote things, except it were by way of comparison." [2]

Mercury and sulphur, themselves, are rejected because the right proportion is unknown; gold and silver are rejected as being too perfect to yield to treatment. What then remains? Writes Bacon in the same work:

> "When we shall find some thing or body extracted from a pure matter, or a more pure *Sulphur* and *Argent*

---

[1] *Op. cit.*, p. 2.

[2] *Ibid.*, p. 4.

> *Vive*, above that which Nature has a little or in some small measure wrought or brought forth; then possibly, by the help of our Fire, and manifold experiences in this our Art, which an Ingenious and continued Oporation upon the matter, through a congruous Decoction, Purification, Coloration, & Fixation, we may attain and perfect the thing sought after." [1]

Yes! When. . . . Such was the dream of every alchemist. Bacon no doubt carried out many interesting and instructive experiments in alchemy; but he failed to achieve the *Magnum Opus*. For his candour in admitting it, no little credit is due to him; it contrasts well with the pretensions of many who had experimented, studying alchemy at first hand, far less than he.

In his *Radix Mundi*, Bacon details the signs whereby the alchemist may know that his work is proceeding aright. These consist of three colour changes in the material operated upon, first to black, then from black to white, and finally from white to red. He writes:

> "This you are to observe, that if between the Blackness and the Whiteness, there should appear the Red or Citrine Colour, you are not to look upon it or esteem it, for it is not fixt but will vanish away. . . . Without you make the White Elixir first, make

---

[1] I have quoted this passage from Salmon's translation, *op. cit.*, p. 629.

the matter become first White, you can never come to the Red Elixir, that which is indeed the true Red."[1]

These three colour stages are evidently the hypothetical metallic equivalents to the three stages in the regeneration of man recognised by mystical theology, and the practical unanimity in which they were believed by the alchemical philosophers as characteristic of the Great Work of alchemy affords striking evidence of the nature of the origin of alchemical theory.[2] Whether Bacon was aware of this origin is another question; possibly he was not.

Modern science, which works from facts to theories, not from theories to facts, stands in strong contrast with the science of the ancients. But despite the insecure basis on which alchemical philosophy was built and the fantastic form its architecture took, it was not altogether a house of delusion. The alchemical philosophers do seem to have grasped by an extraordinary intuition certain fundamental facts concerning the Cosmos, which, lost awhile, are being rediscovered by the more certain, if less rapid, methods of modern science. As a prominent modern chemist has remarked:

---

[1] *Op. cit.*, pp. 607 and 608.

[2] See my *Bygone Beliefs* (1920), chap. ix.

> "It appears that modern ideas as to the genesis of the elements, and hence of all matter, stand in strong contrast with those which chiefly prevailed among experimental philosophers from the time of Newton, and seem to reflect in an altered form the speculative views of the ancients."[1]

On one point Bacon was at variance with current alchemical philosophy, namely, in his rejection of the doctrine of the "first matter." He is not quite consistent, perhaps, in all his utterances on this point, but as developed in his larger works his position is fairly clear. He was a very nominalist of the nominalists—a believer in the reality of the individual. "Matter is not *unam numero*,"[2] he writes, in contradistinction to the currently accepted doctrine. There are, according to him, different kinds of matter distinguished from each other just as different forms are distinguished from each other. "The difference between an ass and a horse is not a difference of form only; it is a difference of matter." When we remember how the superstition of material substance—a substratum to all phenomena, *ex hypothesi* unknown and unknowable—which may be regarded as the philosophical descendant of the alchemical "first matter," has persisted in the mind of science, exercising its darkening influence, even to this present day, we shall realise how wise Roger Bacon was in the one original contribution he made to alchemical philosophy.

---

[1] Sir William A. Tilden: *The Elements: Speculations as to their Nature and Origin* (1910), pp. 108 and 109.

[2] Roger Bacon: *Communium Naturalium*, Pars. II, Dist. ii, cap. 6. See *Opera hactenus inedita Rogeri Baconi*, Fasc. II . . . *edidit* Robert Steele (Oxford, N.D.), p. 90.

CHAPTER V

MEDICINE

In virtue of the alchemical doctrine of the unity of all things, the Philosopher's Stone was regarded not only as the medicine of the metals, but also as the medicine of man. Dissolved in alcohol, or otherwise prepared in a suitable form, it constituted the *Elixir Vitae,* which it was thought would cure all the ills to which flesh is heir, and restore the aged to the vigour of youth. Failing this, gold brought into a potable form was, of course, regarded as a most powerful remedy, a dangerous notion in view of the poisonous nature of the soluble compounds of gold. Fortunately, however, the dissolution of gold is a by no means easy matter to accomplish, and not a few of the elixirs which in the course of the history of alchemy gained popularity were golden only in colour. Thus, the potable gold of the famous alchemist Arnold de Villanova was brandy—certainly a far more beneficent medicine than any preparation really containing gold could have been.

In his *Opus Majus*, Roger Bacon urges, as one of the advantages attaching to the study of experimental science, the possibility of thereby discovering means for the cure of old age and the prolongation of life. As I have previously mentioned, he had already compiled a treatise on the subject (*De retardandis*, etc.), which was translated into English by Dr. Richard Browne, and published in 1683 under the title of *The Cure of Old Age, and Preservation of Youth.*[1] The book contains many sagacious hints on diet (attention to which, Bacon insists, is absolutely necessary) and hygiene, which are in many ways excellent. So far, however, as the special remedies are concerned, Bacon does little more than reflect the current opinions of his day; and it must be confessed that he is here not merely confusing experiment and experience, but accepting, as having a basis in experience, the unfounded statements of other persons. A number of the ingredients of his recipes he describes circuitously, not naming them openly; but it is not difficult to identify the majority of these, which has been done for the reader by the translator of the English edition of the work.

---

[1] Reprinted in *The Code of Health and Longevity*, by Sir John Sinclair, Bart., vol. iv (Edinburgh, 1806).

Gold, of course, is one of the remedies against old age advocated by Bacon. He calls it "this best of Medicines,"[1] for the reason that "there is in it an equal or right Nature, and it is not subject to the Corruption of any of the Elements."[2] He recommends it as particularly efficacious for the cure of headaches, the shaking palsie, and talking in one's sleep (which he refers to as a sort of madness). The other special remedies he mentions include pearls, ambergris, viper's flesh, bone of stag's heart, rosemary and lign-aloes. The reason for the faith in the curative powers of at least some of these bodies is not far to seek. It is to be found in that very primitive belief that by assimilation man acquires the properties of the body assimilated. Amongst many primitive peoples it is the custom of the successful warrior to eat the heart of his unsuccessful, but courageous, enemy, in order that he may acquire the latter's courage. So too, then, was gold thought to be an efficacious medicine against the corruption of old age, because it was itself incorruptible. Stags were believed to live to an excessive length of years—Bacon mentions that one was captured in his days having on a collar with an inscription dating from the time of Julius Caesar. To live long, then, man must appropriate the quality of longevity of the stag by assimilating the bone of its heart. Moreover, when the viper became old, it renewed its youth by casting off its skin; surely man could acquire the power of renewing his youth by assimilating viper's flesh.

---

[1] Roger Bacon: *The Cure of Old Age, and Preservation of Youth, translated out of Latin; with Annotations*, by Richard Browne (1683), p. 73.

[2] *Ibid.*

Such was the main idea at the root of most of Bacon's alleged remedies, and before we blame him too harshly for his belief in it, we must remember how great a credence the idea had gained and how well it seemed to be demonstrated by medical practice. He is certainly to blame for not having applied his own method and insisted on first-hand experimental evidence; but in justice to him we must bear in mind that the idea is by no means defunct, and that it is still to be met with in many places to-day. It is possible, perhaps, to connect with this idea the Christian sacrament of the Eucharist, at any rate if this ritual meal is derived from pagan feasts of eating a god, as has been maintained. It certainly survives in the current belief in the superlatively nutritive value of blood.

Out of this idea, by a process of refinement, arose the mediæval medical theory known as the Doctrine of Signatures, according to which the medicinal value of plants, minerals, etc., is indicated by their external form, or by some sign impressed upon them by the operation of the stars. Thus eye-bright (*Euphrasia officinalis*, L.), a little plant with a black pupil-like spot on its corolla, was thought to be good for eye-complaints; wood-sorrel (*Oxalis acetosella*, L.) was prescribed for heart troubles, because of its heart-shaped leaflets; lungwort (*Pulmonaria officinalis*, L.), whose spotted leaves were thought to resemble the lungs, was administered in the case of pulmonary diseases; and birthwort (*Aristolochia Clematitis*, L.) was, owing to its peculiarly shaped corolla, thought to be useful in parturition. In fact, many of the common names for plants arose as a result of a belief in their medicinal value as indicated by such signatures. The doctrine in question became particularly widespread, and gained very general acceptance during the sixteenth century, no doubt owing to the championship of it by Paracelsus (with whose name it is particularly associated) and contemporary medical philosophers; but it certainly was very much earlier in origin than this, and, although the term "signature" is not employed by Bacon, the concept implied by it is quite explicitly stated by him in the work to which I have already referred in this chapter. He writes:

> "For in whatsoever thing the most High GOD hath put an admirable Vertue and Property, therein he hath also placed an Hurt, to be as it were the Guard of the thing it self. For as he would not have his Secrets known of all, lest Men should contemn them; so he would not have all Men be *Adepti*, lest they should abuse their Power. As is manifest in the Serpent, Hellebore and Gold. From which no man can fetch any noble or sublime Operation, unless he be wise, skilful, and hath of a long time experienced them.
>
> "Besides, wheresoever GOD hath placed such an unspeakable Vertue, he hath added a certain Similitude, that every Man, who is of a clear and vivacious Wit and Understanding, may conceive its Operation.'"[1]

One remedy recommended by Bacon for the cure of old age, and especially for the augmentation of the vital heat, which was somewhat novel to mediæval practice, is that referred to in *The First Book of the Kings*:

> "Now king David was old and stricken in years; and they covered him with clothes, but he gat no heat. Wherefore his servants said unto him, Let there be sought for my lord the king a young virgin: and let her stand before the king, and cherish him;

---

[1] *Op. cit.*, pp. 16 and 17.

and let her lie in thy bosom, that my lord the king may get heat. So they sought for a fair damsel throughout all the coasts of Israel, and found Abishag the Shunammite, and brought her to the king. And the damsel was very fair; and she cherished the king and ministered to him; but the king knew her not."[1]

From the standpoint of the Galenical physiology, which Bacon (in agreement with his contemporaries) accepted in the main, the treatment must have appeared entirely reasonable. Galen taught that health was the result of an equilibrium of the four humours—corresponding to the four Aristotelian elements—assumed to exist in man. These are:

Bile, corresponding to Fire, having the properties of Hotness and Dryness.
Blood, corresponding to Air, having the properties of Hotness and Moistness.
Phlegm, corresponding to Water, having the properties of Coldness and Moistness.
Black bile, corresponding to Earth, having the properties of Coldness and Dryness.

Old age, according to him, resulted from the decrease of the fiery and watery elements; so that remedies suitable for the preservation of youth must be such as would preserve and increase the "innate heat" and "radical moisture" of the body.

---

[1] Chap. i, vv. 1–4.

As I have already remarked, as a dietist and hygienist, Roger Bacon exhibits no little wisdom, whilst in other respects in his contributions to the literature of medicine he appears largely to have forgotten to apply his own method. But his *De retardandis* is particularly useful to the student as a summary of views current in the thirteenth century concerning the cure of old age and the preservation of youth, and from this point of view at least is of considerable value.

CHAPTER VI

MAGIC AND THE DISCOVERY OF GUNPOWDER

Roger Bacon, as I have pointed out, acquired the undesirable reputation of being a magician, a reputation which has clung to him until almost recent times; yet one of his earliest works, *Epistola . . . de secretis operibus naturae et de nullitate magiae*[1] is, as its title indicates, a criticism of magical belief and practice. He writes:

"Concerning those Secrets, which are revealed in Magicians writings, although they may contain some truth, yet in regard those very truths are enveloped with such a number of deceits, as it's not very easie to judge betwixt the truth and falshood, they ought all worthily to be rejected. Neither must men be believed, who would assure us, That

---

[1] The work has frequently been printed, under this title or that of *De mirabili potestate artis et naturae.* Two English translations have also been published, the first, entitled *An excellent Discourse of the admirable Force and Efficacie of Art and Nature,* along with *The Mirror of Alchimy*, in 1597, the second, under the title of *Discovery of the Miracles of Art, Nature, and Magick*, in 1659.

Solomon, or some other of our sage Progenitors were Authors of such Books." [1]

The marvels of magic, Bacon teaches, are either fictitious or are produced by natural means. Nevertheless, he does not quite give up the belief in occult powers and processes. He endeavours to steer a middle course between a scepticism that denies everything and a blind credence that accepts everything, and to show that the element of truth in magic is in harmony with natural law. Thus, concerning charms and talismans, after a criticism of the belief in the efficacy of such objects, he writes:

> "And yet let us take notice, how the Physician, or he that would re-erect a drooping soul, effects his designe by the use of Figures or Charmes, which in themselves are meerly fictitious. . . . Physicians use Figures or Charmes, not for any prevelancy in them, but that the raising of the soul is of great efficacy in the curing of the body, and raising it from infirmity to health, by joy and confidence is done

---

[1] Roger Bacon: *His Discovery of the Miracles of Art, Nature, and Magick. Faithfully translated out of Dr. Dees own Copy*, by T. M. . . . (London, 1659), p. 6. The reference in the closing sentence is no doubt to the celebrated book of ceremonial magic known as *Clavicula Salomonis*; for full details concerning which, see my *Bygone Beliefs* (1920), chap. vi, "The Belief in Talismans," especially p. 65.

by Charmes; for they make the Patient receive the Medicine with greater confidence and desire, exciting courage, more liberal belief, hope and pleasure."[1]

The belief in talismans, as I have pointed out elsewhere,[2] would never have persisted throughout the ages had it not had some basis in experience. I do not know that anyone has stated more succinctly and admirably what this basis is than Bacon has done in these words.

Moreover, Bacon is not prepared to deny a certain power in words and an occult influence—by means of the diffusion of *species*, capable of modification by the will—between objects and persons at a distance. In support of this marvel of nature he advances the influence on iron of the lodestone, and the phenomenon of infection in the case of certain diseases. He also refers, on the authority of Pliny and other ancient writers, to a number of marvels of an apparently similar nature, but which are now known to have no basis in fact. Amongst these may be mentioned the belief that a dog could not bark within the shadow of a hyena, that the basilisk killed its prey by sight alone, and that "a menstrous woman looking in a glasse, doth infect it with spots, like clouds of bloud."[1] A basilisk, no doubt, was a difficult beast with which to experiment, especially as it did not exist; and perhaps to test the third belief involved an experiment unseemly for a friar to undertake. But after making all allowances, it does seem extraordinary that beliefs so easy to invalidate by experiment should have persisted for hundreds of years and should have been tolerated by a man of Bacon's mentality.

---

[1] *Op. cit.*, pp. 8 and 9.

[2] See my *Bygone Beliefs* (1920), chap. vi,

As a final proof of the worthlessness of magic, Bacon adduces a number of marvels which may be produced by Art—that is, by the scientific utilisation of nature's forces. He writes as though these things had been already accomplished, but in truth their achievement was limited to the domain of his own fertile imagination. What, however, is extraordinary is that so many of these speculative wonders of Bacon's have been actualised, in more recent years, by the patient adoption of that method which he himself formulated. He writes:

> "It's possible to make Engines to sail withall, as that either fresh or salt water vessels may be guided by the help of one man, and made sail with a greater swiftness, than others will which are full of men to help them.

---

[1] *Op. cit.*, p. 11. Cf. Pliny's *Natural History*, Bk. vii, chap. xiii.

"It's possible to make a Chariot move with an inestimable swiftnesse (such as the *Currus falcati* were, wherein our fore fathers of old fought,) and this motion to be without the help of any living creature.

"It's possible to make Engines for flying, a man sitting in the midst whereof, by turning onely about an Instrument, which moves artificiall Wings made to beat the Aire, much after the fashion of a Birds flight.

"It's possible to invent an Engine of a little bulk, yet of greater efficacy, either to the depressing or elevation of the very greatest weight, which would be of much consequence in several Accidents: For hereby a man may either ascend or descend any walls, delivering himself or comrads from prison; and this Engine is only three fingers high, and four broad.

"A man may easily make an Instrument, whereby one man may in despight of all opposition, draw a thousand men to himself, or any other thing, which is tractable.

"A man may make an Engine, whereby without any corporal danger, he may walk in the bottome of the Sea, or other water. These *Alexander* (as the Heathen Astronomer assures us) used to see the secrets of the deeps.

"Such Engines as these were of old, and are made even in our dayes. These all of them (excepting only that instrument of flying, which I never saw or know any, who hath seen it, though I am exceedingly acquainted with a very prudent man, who hath invented the whole Artifice) with infinite suchlike inventions, Engines and devices are feasable, as making of Bridges over Rivers without pillars or supporters."[1]

---

[1] *Op. cit.*, pp. 17–19.

In addition to these marvels, he speculates also as to the extraordinary things which may be accomplished in the realm of optics. Glasses to send forth "poisonous infectious influences"[1] are, indeed, beyond the achievement of art or science; but telescopes to make distant things appear near at hand, microscopes to make small objects appear large, and arrangements of mirrors and lenses to produce various optical illusions, such as the multiplication of an object, and the appearance of objects in places where they are not actually situated, all of which Bacon's imagination envisaged, have become commonplace, and are no longer regarded as marvellous. Bacon was particularly interested in optics, and devoted much attention to this subject in his more important works, such as the *Opus Majus*. Moreover, his interest in the subject was not merely theoretical, like that of the Greek and Arabian mathematicians, but was always directed to the possibility of the application of the laws of optics to practical ends. He appears to have had a fairly clear idea of the nature of the microscope; but he cannot be credited with having invented this or any other of the "engines" and optical devices to which I have referred. With him they were pure speculations: it remained for a later generation to validate these speculations through invention.

---

[1] *Op. cit.*, p. 21.

The discovery of one "marvel of art" may, however, be rightly attributed to Bacon, namely, that of gunpowder. In the work already referred to he writes:

> "As to the making Thunder and Lightning in the Air; yea with a greater advantage of horrour, than those which are onely produced by Nature. For a very competent quantity of matter rightly prepared (the bignesse of ones thumb) will make a most hideous noise and corruscation." [1]

And finally, after a chapter devoted to the need of secrecy by the wise, because of the misuse of knowledge made by the vulgar and unworthy, Bacon finishes his book with three chapters, apparently dealing with the Great Work of alchemy, but written in an incomprehensible jargon absolutely unlike that of his alchemical works. These, Lt.-Col. H. W. L. Hime has proved,[2] constitute a cryptogram—the first two chapters dealing with the preparation of pure saltpetre (then recently discovered), the last with the composition of gunpowder from saltpetre, charcoal, and sulphur. Writes Bacon:

---

[1] *Op. cit.*, p. 24.

[2] See his *Gunpowder and Ammunition: their Origin and Progress* (London, 1904), and his contribution to *Roger Bacon: Essays* . . . edited by A. G. Little (Oxford, 1914).

> "But yet of Saltpeter, *LURU VOPO Vir Can Utri* and Sulphur: and so you may make Thunder and Lightning if you understand the Artifice: but you must observe, whether I speak ænigmatically, or according to the truth."[1]

Claims have, indeed, been put forward for the Greek, Arabic, Hindu and Chinese origins for gunpowder; but an examination of the actual records shows that only incendiary, and not explosive, mixtures are really referred to.

In his works written to the Pope, Bacon mentions the composition of gunpowder quite openly. There was no longer any need for secrecy—since the secret had leaked out—and the only application made of the explosive force of gunpowder was in the making of harmless toy-crackers. In the *Epistola*, however, Bacon had hinted at far more momentous applications,[2] and there was then every need for secrecy.

Always, we must remember, the mediæval philosopher worked under the eye of a Church jealous of her prestige, alert to detect and to punish heresy. Thought was circumscribed by authority—outside of orthodox faith it was dangerous to venture. Not less dangerous was it to venture beyond the confines of orthodoxy in practice. Nice distinctions between the powers of nature and the powers of darkness, between art or applied science on the one hand and magic on the other, were apt to be overlooked. We must bear these things in mind in endeavouring to make a final estimate of the worth and significance of Roger Bacon; and if we do this, I think we shall find it easy to forgive him for his faults and failings. We shall forget those times when he allowed his beliefs to be swayed by accepted opinion, and be more astounded than ever by the degree to which his mind escaped from the bonds of authority, and dared to think independently for itself. We shall estimate highly his power of scientific speculation, even if it sometimes led him astray, his broad-minded appreciation of the moral teachings of non-Christian writers, his splendid view of philosophy as embracing the whole of what is knowable. And, above all, we shall value him as the thinker who laid the foundations of scientific method, whereon has been built the true house of knowledge for the use and delight of all mankind.

---

[1] *Op. cit.*, p. 50.

[2] Roger Bacon was unacquainted with the propulsive power of gunpowder. This discovery, so detrimental to the happiness of mankind ever since, was made by Berthold Schwarz about 1330.

PRINTED BY
HAZELL, WATSON AND VINEY, LD.,
LONDON AND AYLESBURY.